

University Programs of the Advanced Fuel Cycle Initiative

Dr. Denis Beller
University Programs Leader
LANL AFCI Program Office

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ADVANCED FUEL CYCLE INITIATIVE



Major university activities

- **UNLV Transmutation Research Program**
- **Idaho Accelerator Center at ISU**
- **LANL Directed University Research**
- **University Fellowship Program**
- **Laboratory interns**
- **Others**

\$7 M funds supported more than 115 students* in FY02

U. of Nevada, Las Vegas	49
Idaho State U.--IAC	20
M.S. Fellowships	20
interns (LANL, ANL, ORNL)	20
Directed University Research	14
Seaborg Inst. Summer School	2

Total **115 plus**

*some students have been or are in more than one category

The lead AFCI academic program is the U of Nevada, Las Vegas TRP

- Dr. Anthony Hechanova is Director
- \$3 M FY01, \$4.5 M FY02 (\$4.5 M FY03)
 - Program Support
 - Student-based research
 - Infrastructure
 - International collaboration
- 16 diverse peer-reviewed research projects
- See aaa.nevada.edu

Breadth of UNLV TRP Research

- Involves three colleges and one research center
- 26 graduate assistantships
- 23 undergraduate students
- Research Topics: accelerator, targets, materials, separations, experiments, fuel, criticality, ES&H, Lead-Bismuth
- New equipment and labs

Idaho Accelerator Center at Idaho State University

- Dr. Frank Harmon is director
- \$1.5 M FY02 (\$3.5 M FY03)
- Diverse Research:
 - Positron Annihilation for Materials Stress Analysis
 - Dose Conversion Coefficients
 - Coupled Accelerator-Reactor Experiments
- Collaborations

LANL-directed University Research

U.C. Berkeley

U. of Michigan*

U. of Texas-Austin

**North Carolina
State U.**

***ANL too**

U. of Illinois

U. of Florida

**Georgia Inst. of
Tech.**

Arizona State U.

**Imperial College of
London**

LANL-directed University Research

- **U.C. Berkeley reactor studies:**
 - Molten-Salt
 - Na versus Pb-Bi coolants for metallic fuel ATW
 - Pebble-bed ATW
- **University of Michigan**
 - Space-Time Dynamics Analysis
 - Support for LANSCE experiments
 - Proton irradiation testing

LANL-directed University Research

- **U. of Texas-Austin**
 - Proliferation resistance assessment
 - New: LANSCE cross section measurements
- **North Carolina State University**
 - radiation damage for CINQ targets at PSI
- **University of Illinois**
 - oxidation in LBE systems
- **University of Florida**
 - radiation damage to oxide coatings in LBE sys
- **Georgia Tech**
 - Dose Conversion Factors for spallation products

U of Mich ATW Studies (PI Prof. John Lee)

- **Cross-Validation of Neutronics Tools -- Jeff Davis, David Griesheimer, Reuben Sorensen**
- **Fast Flux Depressions in Lead and Bismuth -- Prof. Holloway**
- **Space-Time Dynamics Analysis -- Viktoriya Kulik**
- **Support for experiments, conduct experiments -- Jim Platte (Fellow)**

U of Mich Irradiations (PI Prof. Gary Was)

- Added in FY02 to support LANL's materials studies
- at U of Mich, LANL tech rep is Ning Li
- Irradiation testing of HT-9 and T-91 steels
- H and He implantation to 3.0, 7.0, and 10.0 dpa

UC Berkeley ATW studies (PI Prof. Ehud Greenspan)

- **Once-Through Molten-Salt Reactor study -- Elena Vietez, et al.**
- **Optimization of transmutation rates**
- **Developing quick system to evaluate multi-recycle transmutation schemes without core design codes**
- **Na versus Pb-Bi coolants for metallic fuel ATW – Darby Kimball**

UC Berkeley more studies

- **Flattening k_{eff} & increasing fractional transmutation by:**
 - ^{99}Tc as burnable absorber – Hiroshi Sagara
 - Adding Th – Gonta Kawasaki
 - two spectral zones – Nate Stone
- **Pebble-bed ATW – Hiroshi Matsumoto**

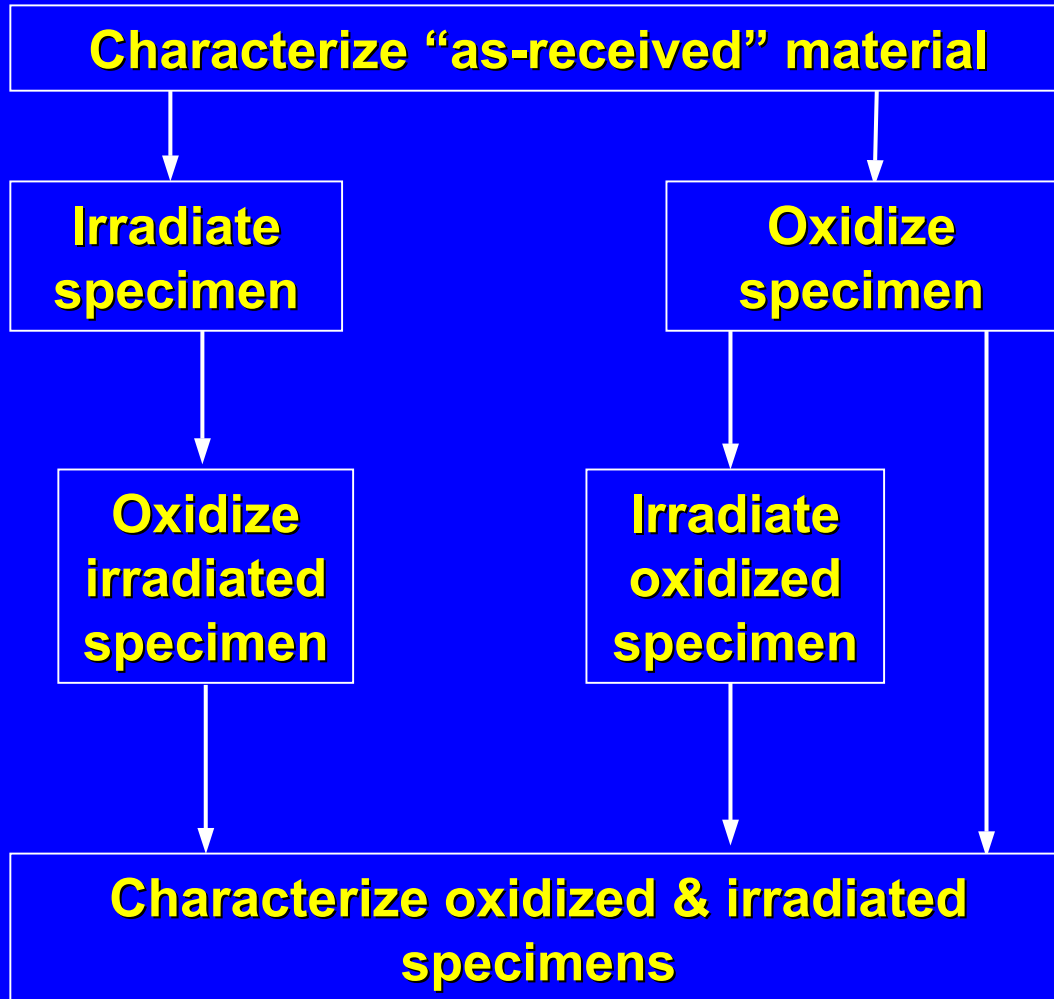
U of Texas-Austin (PI Prof. William Charlton)

- **Proliferation resistance assessment**
 - MAUA -- Ryan Lebouf
 - PRA methodology -- Suresh Aghara
 - Metrics -- Coy Bryant (Fellow)
- **Added LANSCE experiment**
 - Cross section measurements of fission foils
 - Summer 2003

U of Florida (PI Prof. Darryl Butt)

- **Objectives**
 - Investigate the influence of radiation on the oxidation rate & oxides formed on selected structural alloys
 - Characterize the oxide/substrate interface & oxides after the irradiation process
- **Scott Lillard is LANL technical lead**

U of FI Experimental Procedure



- **Proposed procedure**
- **Oxidation process**
 - Environment: dry air
 - Temperature range: 300° C to 700° C
 - Exposure time: 48 hours
- **Irradiation process**
 - 3.2-MeV proton ion beam
 - Temperature: 360° C
 - Dose: 1 dpa

U of FI Characterization Techniques

- **Thermogravimetric analysis (TGA/DTA)**
 - Obtain oxidation rates
 - Determine oxidation kinetics/mechanism
- **Transmission electron microscopy (TEM)**
 - Elucidate oxide/substrate interface & oxide structure
 - Assess structural changes

U of Illinois (PI Prof. Jim Stubbins)

- Corrosion probes for lead-bismuth (LBE) systems
- AFC Fellow Alan Bolind
 - Constructing a test loop
- Ning Li is LANL technical lead

Georgia Tech (PI Prof. Nolan Hertel)

- **Consultant to LANL**
- **Dose conversion coefficients (DCC)**
 - ~700 radioisotopes will be created in a spallation target, need to be characterized
 - DCC Working Group:
 - » UNLV is lead
 - » ISU
 - » UT/ORNL
 - » U of Florida

NCSU (PI Prof. Monroe Wechsler)

- Calculations of radiation damage for SINQ targets (PSI)
- Student Wei Lu
- Ning Li is LANL technical lead
- Mark II ('98 and '99 under STIP-I)
- Mark III (Zirc-2)
- Target 5 (Pb, STIP-III)

University Fellowship Program

- \$500 k annual
- Ten M.S. Fellowships
 - \$42,500 per student
- Administered by URA
 - direct, not through universities
- Summer employment at labs
- AFCI-related thesis process

Ten Interns and GRAs worked at LANL during FY02

- James Platte, Michigan, spallation experiments at LANSCE
- Daniel Lowe, UNLV, supported by UNLV while he did spallation experiments at LANSCE with Fellow Jim Platte
- R. Karen Corzine, Georgia Tech, neutronics calculations for the proposed Fuels and Materials Test Station
- Rob Rutherford, Cincinnati, Fuels
- Gerald Egeland, NM Tech, Fuels

Interns and GRAs (cont'd)

- **Eric Henderson, SD Sch of Mines & Tech, Fuels**
- **Ahmad Douglas, Allegheny College, modeling**
- **Andrew Thompson, Brigham-Young, modeling**
- **Mark Cerutti, UC San Diego, CFD simulation of spallation target**
- **Krishna Muralidharan, Arizona, modeling**

University research will increase in the future

- UNLV TRP expansion & increase
- Idaho State: IAC + Nuclear + Defense
- University Consortium for Transmutation Research
- Fellowship program, add Ph.D.s?
- Seaborg Institute, SARA, other?
- Projection: more than 150 students and \$10 M